

# Current status of rehabilitation in patients with extracorporeal membrane oxygenation in South Korea

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## INTRODUCTION

Extracorporeal membrane oxygenation (ECMO) is a lifesaving technology in critically ill patients with cardiopulmonary failure. As rehabilitation can improve the functional status of critically ill patients, the importance of rehabilitation after ECMO is also increasing. But in South Korea, there are few studies about the rehabilitation in patients with ECMO.

## OBJECTIVE

We aimed to assess the clinical characteristics between rehabilitation and non-rehabilitation groups to examine any trend in rehabilitation among patients with ECMO. And the factors associated with rehabilitation in patients with ECMO were investigated.

## METHODS

### Study population and data collection

- Health Insurance Review and Assessment Service (HIRA) in South Korea
- Based on claim codes that hospitals submitting cost claims to HIRA
- Between January 1, 2014 and December 31, 2018
- Inclusion
  - 10 to 90 years of age who had been treated with ECMO
- Exclusion
  - stayed hospital for shorter than 72 hours
  - In-hospital deaths in the non-rehabilitation group

From January 1, 2014 to December 31, 2018  
6515 patients treated with ECMO

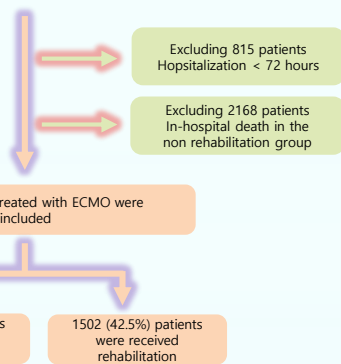


Fig. 1. Flowchart of study participants.

## RESULTS

Table 1. Multivariable regression for rehabilitation of patients with ECMO treatment in South Korea.

Variables	Odds ratio (95% CI)	p-Value
<b>Sex</b>		
male	1 (reference)	
female	0.994 (0.754-1.309)	0.964
<b>Primary diagnosis</b>		
cardiovascular	1 (reference)	
<b>respiratory</b>	<b>1.437 (1.014-2.036)</b>	<b>0.041</b>
neoplasm	1.455 (0.853-2.481)	0.169
gastrointestinal	1.143 (0.476-2.748)	0.765
others	0.971 (0.655-1.440)	0.884
<b>MV duration</b>		
1-4	1 (reference)	
>4	<b>0.005 (0.004-0.008)</b>	<b>&lt;0.001</b>
<b>ICU LOS</b>		
≤7	1 (reference)	
>7	<b>13.822 (10.013-19.079)</b>	<b>&lt;0.001</b>
<b>Hospital LOS</b>		
	<b>1.067 (1.056-1.079)</b>	<b>&lt;0.001</b>
<b>Region</b>		
Gwangju, Jeonnam	1 (reference)	
<b>Seoul</b>	<b>1.920 (1.089-3.383)</b>	<b>0.024</b>
Gyeonggi	1.480 (0.774-2.831)	0.236
Incheon	0.563 (0.259-1.221)	0.146
Gangwon	1.583 (0.466-5.385)	0.462
Daegu-Gyeongbuk	1.701 (0.752-3.845)	0.202
Jeonbuk	1.778 (0.395-7.997)	0.453
Daejeon-Chungnam	0.883 (0.366-2.132)	0.783
<b>Bu-UI-Gyeong</b>	<b>2.489 (1.181-5.247)</b>	<b>0.017</b>

### AUC : 0.952

Abbreviation; CI, confidence interval; AUC, area under the curve; MV, mechanical ventilation; ICU, intensive care unit; LOS, length of stay; Bu, Busan; UI, Ulsan; Gyeong, Gyeongnam;

- Longer ICU and hospital stay were associated with rehabilitation
- Mechanical ventilation >4 days was negatively affecting factor
- Patients with respiratory disease were more likely to receive rehabilitation than patients with cardiovascular disease
- Seoul and Bu-UI-Gyeong were more likely to prescribed rehabilitation than Gwangju, Jeonnam

## DISCUSSION

Patients with **longer ICU LOS had received more rehabilitation**. The longer the LOS in the ICU, the higher the possibility of ICU acquired weakness, which **increases the need for rehabilitation**.

Patients with **respiratory disease were prescribed more rehabilitation**. Considering that rehabilitation referrals are made by doctors, suggested that **there is a difference in perception for rehabilitation in patient received ECMO**.

Use of **mechanical ventilation for more than 4 days was negative predictor of rehabilitation**. It is possible that patients under mechanical ventilation were stayed longer and at high risk for functional impairment. However, when the length of ICU stays was equal, these patients received less rehabilitation. Therefore, it is suggested that **mechanical ventilation device itself may acts as a rehabilitation barrier**.

Patients with **longer hospital LOS had received more rehabilitation**. Patients who need more critical care may need longer hospital stays in tertiary hospitals. So, the demand for rehabilitation might be much higher in that patients.

Rehabilitation were **prescribed more in regions that had large number of hospitals with cardiac rehabilitation programs including regional cardiocerebrovascular center**. The lack of healthcare infrastructure and systems may have affected rehabilitation in patients with ECMO.

## CONCLUSION

Our results suggest that physical, clinicopathological conditions and regional difference associated with rehabilitation in patients with ECMO. More clear and timely studies are needed to meet the rehabilitation needs of patient who received ECMO.